CHAPTER 3: AVIATION ACTIVITY FORECASTS

Introduction

The Aviation Activity Forecasts chapter of the Airport Master Plan analyzes current and future airport activity at the Perham Municipal Airport (16D). Forecasting provides an airport with a general idea of the magnitude of growth, as well as fluctuations in activity anticipated over the forecast period. They assist the Airport in determining existing and planned future facility needs based on airport activity level estimates and projections. Forecasts attempt to develop a realistic estimate of future changes.

Forecasting efforts are based on a "snapshot" of existing aviation trends and socioeconomic climate. As such, forecasting tends to be a dynamic element of airport master planning. When conditions change dramatically, forecasts should be reviewed and updated accordingly to reflect the changed environment.

The forecasts developed for Perham will be important to adequately plan, size, and sequence development of future facilities to meet future projected growth. Development at airports, however, is demand-based from actual numbers rather than forecasts. The alternatives and concepts developed for Perham will have the capacity and flexibility to handle aviation activity far beyond what is projected in this chapter.

To thoroughly analyze and develop a probable aviation forecast, a technical review has been completed using several methods to help quantify potential aviation activity over the next 20 years.

This chapter includes aviation activity forecasts for the following primary elements:

- Based Aircraft
- General Aviation Operations
- Critical Design Aircraft

Forecast Rationale

Forecasting the demand for airport use is a critical step in airport development. It allows an airport to examine its ability to satisfy the needs of the aircraft and people it serves, and to determine the approximate timing of necessary improvements by projecting airport user activity levels.

Every 5-7 years, the Minnesota Department of Transportation (MnDOT) – Office of Aeronautics updates the State Aviation System Plan (SASP) to reflect the current social, demographic, economic, and aviation trends. The 2012 Minnesota SASP, published in July 2013, is the most recent update available when the forecasting effort began for this study. The forecast model for Perham Municipal Airport from the 2012 MN SASP was utilized for this report.

Factors Affecting Forecasts

FAA provides general guidance in evaluating factors that affect aviation activity. FAA AC 150-5070-6B states:

"Planners preparing forecasts of demand or updating existing forecasts should consider socioeconomic data, demographics, disposable income, geographic attributes, and external factors such as fuel costs and local attitudes towards aviation."

For purposes of this forecast, the following defining factors have been used to develop the forecast:

1. Based on availability of data when the project began, calendar year 2018 has been used as the baseline year.
2. FAA data from 2018 (where available) has been used to validate forecast assumptions and update the forecast baseline.
3. The forecast period is 20 years, encompassing years 2018 through 2038.

The forecasts prepared for the airport assume an unconstrained scenario where facilities are available for use to meet demand. Any constrained forecasts prepared will be noted throughout the document. Time periods include short-term (5-year), mid-term (10-year) and long-term (20-year) resulting in forecasts for year 2023, 2028, 2038. Forecasts may be developed using a composite of methodologies over the planning period.

Forecasting Methods

Various methodologies are used to develop aviation forecasts. Forecasts should not be considered predictions of the future but rather an educated projection of future activity. Some of the following forecasting methods were applied for this analysis, including trend extensions, market share analysis, regression analysis, socioeconomic methodologies, and professional judgment.

TREND EXTENSIONS

A trend extension forecast identifies historical growth patterns and projects those patterns into the future. Often, a trend line can be drawn through a graph of the historical data to reveal an overall trend, which can then be extended into the immediate future to develop a forecast.

MARKET SHARE ANALYSIS

Market share analysis assumes a relationship between local and national/regional forecasts. The market share approach to forecasting is a top-down method where activity at an airport is assumed to be tied to growth in some external measure (typically a regional, state, or national forecast).

REGRESSION ANALYSIS

Regression analysis is a statistical technique for estimating the relationships among variables. It identifies the correlation between a known independent variable(s) (e.g., estimates and projections of population, income, etc.) and the dependent variable(s) (e.g., based aircraft or aircraft operations).

PROFESSIONAL JUDGMENT

Judgmental methods are educated estimations of future events based on the industry knowledge, experience, and intuition of the forecaster. This method permits the inclusion of a broad range of relevant information into the forecasting process and is usually used to refine the results of the other methods.

Socioeconomic Data

Socioeconomic information can provide insight into factors that affect aviation activity at an airport. Commonly evaluated metrics include population, employment, income, gross regional product, and retail sales. Historic trends, current data and forecast estimates are evaluated in this section to identify socioeconomic trends that may affect aviation activity forecasts at Perham. Growth rates are used as a method to compare the airport service area to other regional, statewide, and national trends.

For the purposes of this study, Woods and Poole Economics 2016 data for Otter Tail County was used for local projections of socioeconomic and demographic trends as most projections were not available for the City of Perham. **Table 3-1 – Economic and Demographic Forecasts** provides the projected levels of Population, Employment, and Income for the airport service area.

Table 3-1 – Economic and Demographic Forecasts – Otter Tail County

Year	Population	Employment	Income 2005 *Dollars*
2018	*58,700*	*36,321*	*40,098*
2023	*60,048*	*38,561*	*43,688*
2028	*61,302*	*40,596*	*47,140*
2033	*62,355*	*42,412*	*50,070*
2038	*63,081*	*44,028*	*52,852*
Forecast Annual Growth Rate	*0.36%*	*0.97%*	*1.39%*

Source: Woods & Poole Economics (2016)

Population

Population is often a key indicator of based aircraft and operation levels at airports. In general, as the population of an airport's service area decreases or increases, based aircraft and operation numbers typically decrease or increase correspondingly. Since the 2010 Census, the estimated population of the City of Perham increased annually at a rate of 1.85% as shown in **Table 3-2**.

Table 3-2 – City of Perham –Population

	2010 Census	2011	2012	2013	2014	2015	2016	2017	CAGR
Perham, MN	*3,009*	*3,016*	*3,035*	*3,100*	*3,197*	*3,285*	*3,313*	*3,421*	***1.85%***

Source: U.S. Census Bureau -Vintage 2017 City and Town Population Totals: 2010-2017

Income

Per Capital Personal Income (PCPI) was also considered as a factor affecting aviation activity. Those who have more disposable income may have a higher propensity to utilize the time savings of aviation, or simply more disposable income for leisure. Growth in PCPI for Otter Tail County is projected to increase 1.39% annually.

Employment

Total employment is the measure of the active workforce and may be an indicator of aviation activity levels. Total employment in Otter Tail County is forecast to grow annually at 0.97%

According to Woods and Poole data, the top five industries providing jobs in Otter Tail County include:

1. Health Care and Social Assistance → 4,530 Jobs
2. Retail Trade → 4,073Jobs
3. State & Local Government → 3,642 Jobs
4. Farming→ 3,223 Jobs
5. Construction → 2,568 Jobs

Based Aircraft

A based aircraft is an operational and airworthy aircraft claiming an airport as its home for most the year. The number and mix of based aircraft are an indication of the demands for airport facilities and services, such as tie-downs, hangars, fuel facilities, and FBOs. The number of based aircraft also influences the volume of aircraft operations.

Historical Data and Trends

NATIONAL

Based on the 2019 FAA Aerospace Forecast, it was noted general aviation aircraft deliveries began to increase in 2018, following several years of gradual decline in deliveries. The Aerospace Forecast projects the long-term outlook for general aviation to remain stable. FAA Terminal Area Forecast (TAF) anticipates an annual growth rate for based aircraft nationally at 0.80 percent through 2038 with the highest growth sectors in total aircraft being the turbine, experimental and light sport fleets.

REGIONAL

Historically, based aircraft in Minnesota have increased 0.94 percent annually from 2010-2018 according to the FAA TAF. The latest SASP update in 2012 concluded that based aircraft in the Minnesota airport system would increase on average of 1.00 percent annually through 2030. The FAA TAF estimates based aircraft in Minnesota will see 0.36 percent annual growth through 2038.

LOCAL

FAA records on the historical and projected numbers of based aircraft at Perham are limited. This information is usually available in the FAA TAF which is not published for Perham as it is not included in the National Plan of Integrated Airport Systems (NPIAS). Current figures are available through the FAA's Airport Master Record (Form 5010) which reports Perham as having 16 based aircraft in December 2018.

The reported based aircraft at Perham in the Minnesota SASP was 14 in 2010 and was estimated to grow to 17 by 2030. The SASP projected an annual growth rate of 0.98 percent for Perham over the planning period.

The number of aircraft based at Perham have generally been related to the number of aircraft storage units available. All based aircraft are stored in aircraft hangars which is at capacity. The airport currently has a list of 7 individuals waiting for T-hangar storage to become available. According to airport records, there are 21 aircraft based on the airfield which will be used as the baseline for forecasting purposes. The based aircraft fleet mix can be found in **Table 3-3** below which is based off the Master Record and modified to account for the 21 based.

Table 3-3 – Based Aircraft Fleet Mix

Aircraft Type	Based Aircraft
Single-Engine	16
Multi-Engine	2
Jet	-
Helicopter	2
Ultralight/Other	1
Total Based Aircraft	**21**

Source: FAA Airport Master Record (16D,12/2018), KLJ Analysis

Forecast

Local and regional trends were evaluated when preparing this forecast of based aircraft at Perham. It is estimated that based aircraft will grow at Perham for several reasons:

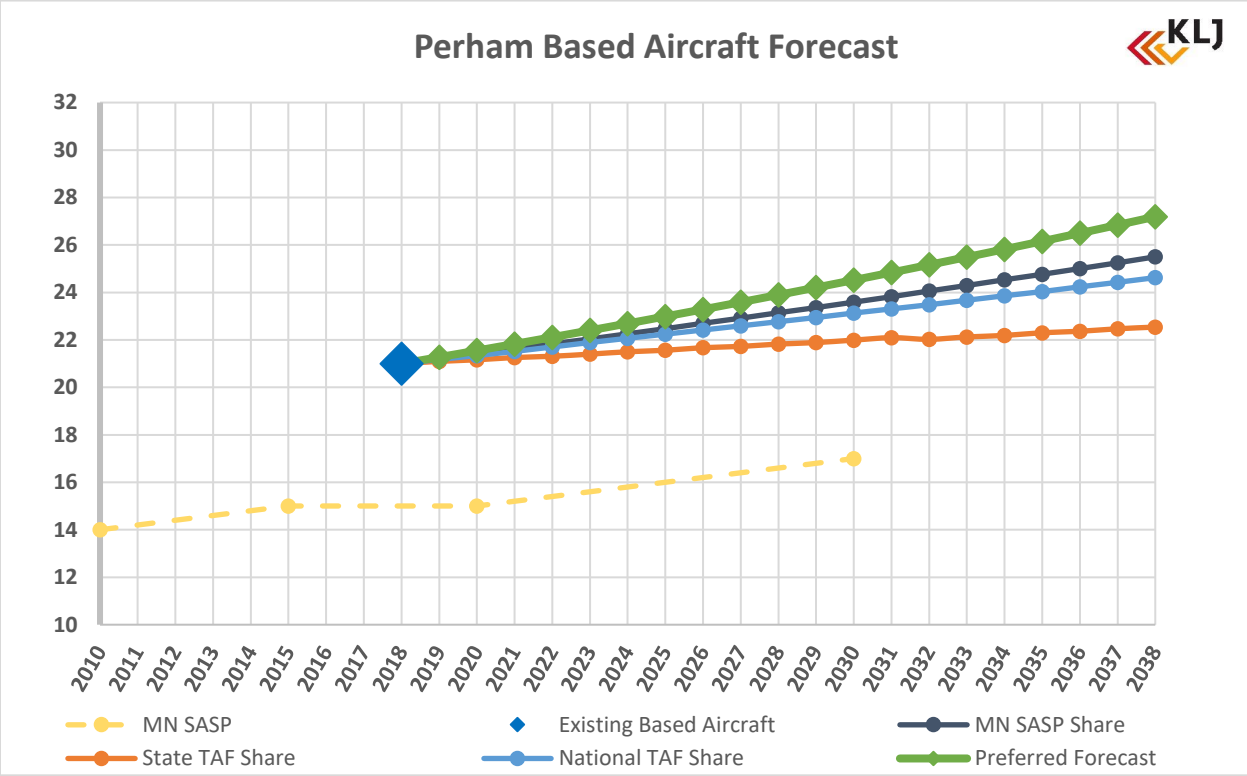
- The forecasted increase in the employment, income, and population within the airport service area supports additional aviation growth. Historically in Minnesota, based aircraft have grown at about the same rate (0.97 percent) as the state population (0.94 percent[1]). This correlation suggests based aircraft would increase based on the growth of these socioeconomic indicators.
- There is demand to locate additional aircraft to Perham. Aircraft hangars on the airfield are at maximum occupancy with 7 individuals on a waitlist to occupy T-hangar units as they become available.
- The airport has a runway length (4,102 feet) that generally can accommodate regular use of larger twin-engine piston and most turboprop aircraft, eliminating most limitations for these aircraft types, which national trends indicate will experience fleet growth during the planning period.

A market share analysis of the regional and national based aircraft forecasts was also evaluated. The Minnesota State TAF and National TAF projected annual growth of based aircraft at 0.36 and 0.80 percent respectively through 2038. The MN SASP is the only published document that has a forecast specific to Perham. The SASP estimated based aircraft at Perham to grow annually at 0.98 percent through the planning period of 2030. These forecasted projections can be found in **Exhibit 3-1**. With the relatively small number of based aircraft at an airport like Perham, an increase in a few aircraft makes a significant increase in annual growth rates. For this reason, annual growth rates are not used as the sole basis for forecasts.

Based on the expected economic conditions of the area and the current demand for additional hangar storage, a growth rate slightly more optimistic than the 0.98 percent from the SASP was determined to be reasonable for the planning period. The preferred forecast estimates that the number of based aircraft at Perham would grow at an annual rate of 1.30 percent. This equates to 6 additional aircraft based at Perham during the planning period for a total of 27 based aircraft by 2038.

[1] CAGR calculated from 2016 Woods & Poole Economics; Minnesota Population (2010-2016)

Exhibit 3-1– Based Aircraft Forecasting Methods



Source: KLJ Analysis

Table 3-5– Based Aircraft Forecast

Metric	2018	2023	2028	2033	2038	*CAGR*
Single-Engine	16	17	18	19	20	1.01%
Multi-Engine	2	2	3	3	4	3.63%
Jet	0	0	0	0	0	-
Helicopter	2	2	2	2	2	0.42%
Ultralight/Other	1	1	1	1	1	1.55%
Total Based Aircraft	21	22	24	25	27	1.30%

Source: KLJ Analysis. CAGR = Compounded Annual Growth Rate

Aircraft Operations

An operation is an aircraft landing or takeoff. Aircraft operations are split into two categories; local and itinerant. Local operations are performed by aircraft that remain in the local traffic pattern and stay within a 20−mile radius. These operations typically include practice landings, touch-and-go operations, practice approaches and maneuvering within the local area. Local operations are usually performed by recreational and flight training aircraft.

Itinerant operations are performed by a landing aircraft arriving from outside the airport area (20 miles) or a departing aircraft that leaves the airport area. Itinerant operations are conducted in all types of aircraft.

Historical Data

Perham is a non-towered general aviation airport with non-precision instrument approaches. Consequently, there is no accurate method to determine itinerant or local operations. The FAA Master Record provides the most recent estimate of operations at Perham with 7,200 annual operations in 2018.

The reported total operations at Perham in the Minnesota SASP was 7,199 in 2010 and was estimated to grow to 9,660 by 2030. The SASP projected an annual growth rate of 1.48 percent for Perham over the planning period. Both the Master Record (5010) and the MN SASP identified 70 percent of operations as local with the remaining as itinerant.

Forecast

For the aircraft operations forecast at Perham, it was determined a top-down approach was the most reasonable. For Perham, the focus is only on general aviation operations as there are no military or commercial operations conducted at the airport.

According to FAA Order 5090.3C paragraph 3-2 c. a satisfactory procedure for forecasting operations is to use a range of operations per based aircraft (OPBA); see **Table 3-6**. For an airport and community the size of Perham, an OPBA of 250 is usually appropriate. However, recognizing the area's lake resort communities and tourism industry, an OPBA of 300 would better represent the increased traffic Perham sees through peak summer season. The 300 OPBA was then multiplied by the forecasted number of based aircraft throughout the planning period to determine the total operations. This resulted in 6,300 total operations as a baseline with an estimated 8,157 total operations by 2038 following the same annual growth rate as the based aircraft forecast of 1.30 percent.

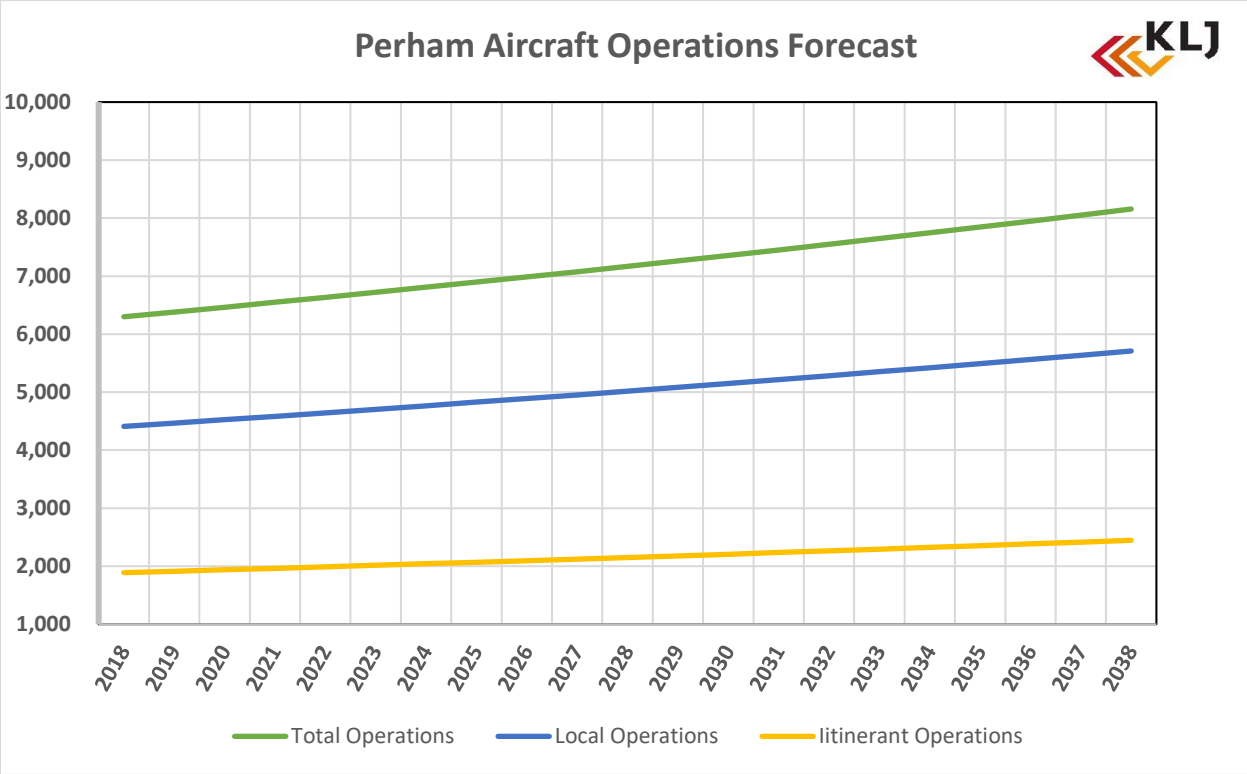
Table 3-6 – FAA Guidance on Forecast Operations per Based Aircraft

	Annual Operations Per Based Aircraft
Rural General Aviation Airports (little Itinerant)	*250*
Busier General Aviation Airports	*350*
Busy Reliever Airports	*450*
Busy Reliever Airport (large Itinerant activity)	*750*

Source: FAA Order 5090.3C Field Formulation of the National Plan of Integrated Airport Systems (NPIAS)

To determine the number of local and itinerant operations, a top-down approach was utilized taking the total number of operations forecasted and dividing by established percentages for each category. The percentages are based on the makeup of local (70%) and itinerant operations (30%) from the MN SASP which was determined to be an appropriate breakdown. A summary of the forecasted local and itinerant operations is available in **Table 3-8**.

Exhibit 3-2 – GA Itinerant Forecasting Methods



Source: KLJ Analysis

Table 3-8 – Total Operations Forecast Summary

Metric	2018	2023	2028	2033	2038	CAGR
Local Operations	4,410	4,704	5,018	5,353	5,710	1.30%
Itinerant Operations	1,890	2,016	2,151	2,294	2,447	1.30%
Total Operations	**6,300**	**6,720**	**7,169**	**7,647**	**8,157**	**1.30%**

Source: KLJ Analysis, CAGR = Compounded Annual Growth Rate
Note: Some numbers may not add up due to rounding

Fleet Mix

The overall airport operations fleet mix combines commercial and general aviation operations using estimated percentages.

When determining a fleet mix of aircraft at a general aviation airport, information is typically limited to what the sponsor sees or who is based on the airfield. However, most operations conducted under IFR are tracked by FAA at airports that have Instrument procedures. The drawback of this data is it does *not* cover those aircraft operating under VFR or outside of a radar environment. For VFR flights, interpolation and estimating is required. Most corporate general aviation aircraft and commercial aircraft operate under IFR.

Data was collected from the FAAs Traffic Flow Management System (TFMS) database to help determine an overall aircraft fleet mix. As stated above this data only provides a look at IFR operations. VFR operations at Perham are typically conducted in single engine and multi-engine piston aircraft. Modifications have been made based on available local data, local user projections, broader industry trends and professional judgement to account for anticipated future user fleet mix changes. The Perham fleet mix is not expected to change significantly over time. The overall estimated fleet mix share breakdown is identified in **Table 3-9**.

Table 3-9– Fleet Mix Share Breakdown

Metric	2018	2023	2028	2033	2038	CAGR
Single-Engine Piston	65.00%	64.00%	63.00%	62.00%	61.00%	-0.32%
Multi-Engine Piston	15.00%	15.75%	16.00%	16.50%	17.00%	0.63%
Turboprop	7.75%	8.00%	8.50%	9.00%	9.50%	1.02%
Turbojet	0.25%	0.25%	0.50%	0.50%	0.50%	3.53%
Helicopter	5.00%	5.00%	5.00%	5.00%	5.00%	0.00%
Ultralight/Other	7.00%	7.00%	7.00%	7.00%	7.00%	0.00%

Source: KLJ Analysis, CAGR = Compounded Annual Growth Rate

The total annual operations are prorated by the estimated fleet mix share percentage to yield a fleet mix operational forecast.

Table 3-10 – Total Operations Fleet Mix Forecast

Metric	2018	2023	2028	2033	2038	CAGR
Single-Engine Piston	4,095	4,301	4,516	4,741	4,976	0.98%
Multi-Engine Piston	945	1,058	1,147	1,262	1,387	1.94%
Turboprop	488	538	609	688	775	2.34%
Turbojet	16	17	36	38	41	4.87%
Helicopter	315	336	358	382	408	1.30%
Ultralight/Other	441	470	502	535	571	1.30%
Total Operations	**6,300**	**6,720**	**7,169**	**7,647**	**8,157**	**1.30%**

Source: KLJ Analysis

Critical Design Aircraft

The critical design aircraft is identified as the most demanding aircraft or family of aircraft to regularly use the airport. A critical design aircraft type or family must operate at least 500 annual operations at the airport to be considered "regular" use by FAA for improvements to be justified for FAA funding.

A review of the FAA Traffic Flow Management System (TFMS) data was also used to aid in determining the design aircraft. At Perham, a fleet mix including turboprop and small jet aircraft were the largest aircraft types to operate to the airport. Historical IFR operations data is shown below in **Table 3-11**. Again, this data only shows a portion of the airport operations that operate under IFR. Most VFR operations at Perham are typically conducted in single engine piston aircraft.

Table 3-2 – TFMS Data Fleet Mix (2013-2018)

Aircraft ID	Type	ARC	Operations
C310	Multi Engine Piston	B-I, Small	204
BE20	Turboprop	B-II, Small	107
C210	Single Engine Piston	A-1, Small	96
C421	Multi Engine Piston	A-1, Small	83
PA34	Multi Engine Piston	A-1, Small	69
PA32	Single Engine Piston	A-1, Small	55
PA46	Turboprop	A-1, Small	50
C172	Single Engine Piston	A-1, Small	46
C550	Turbojet	B-II	41
C182	Single Engine Piston	A-1, Small	37
SR22	Single Engine Piston	A-1, Small	33
BE36	Single Engine Piston	A-1, Small	26
BE9L	Turboprop	B-II, Small	26
C425	Turboprop	B-I, Small	24
EC45	Helicopter	-	22
P28A	Single Engine Piston	A-1, Small	22
M20T	Single Engine Piston	A-1, Small	22
COL4	Single Engine Piston	A-1, Small	21
M20P	Single Engine Piston	A-1, Small	19
C414	Multi Engine Piston	B-I, Small	16
Total Top 20 Sample			**1,019**
Single Engine Piston (37.0%)			377
Multi Engine Piston (36.5%)			372
Turboprop (20.3%)			207
Turbojet (4.0%)			41
Helicopter (2.1%)			22
Total 2013-2018 IFR Operations			**1,228**

Source: FAA Traffic Flow Management System (TFMS), KLJ Analysis

While a large majority of the operations at Perham are A/B-I, Small aircraft, it is important to note there have been a growing number of Beechcraft King Air 200 aircraft operations from 10 in 2014 to 36 by 2018. The King Air 200 is a B-II, Small aircraft. These aircraft are mostly operating as medical life flights for the community. We recommend designating the Beechcraft King Air 200 as the critical design aircraft to ensure the fleet can continue to provide this vital service to the community.

Based on current trends, the future fleet mix for Perham is not expected to change appreciably. The forecast fleet mix, as show in **Table 3-10**, is based on national trend forecasts. It shows a slight increase in operations for all aircraft, resulting in a relatively constant fleet mix for Perham. Consequently, the critical design aircraft for Perham remains the King Air 200 (A/B-II, Small).

Exhibit 3-3– Existing Critical Design Aircraft Family

ARC A-I/Small Aircraft		ARC A-II/Small Aircraft	
Cessna 421		Pilatus PC-12	
ARC B-II/Small Aircraft		**ARC B-II**	
Beech King Air 90		Air Tractor 802	
Beech King Air 200		Cessna Citation II	

Photography Source: Airliners.net

Forecast Summary

Table 3-12– Aviation Activity Forecast Summary

	Activity Levels					Average Annual Compound Growth			
A. Forecast Levels	**2018**	**2023**	**2028**	**2033**	**2038**	**0-5 Years**	**0-10 Years**	**0-15 Years**	**0-20 Years**
Operations									
Itinerant									
Air Carrier	-	-	-	-	-	-	-	-	-
Commuter/Air Taxi	-	-	-	-	-	-	-	-	-
Total Commercial Operations	-	-	-	-	-	-	-	-	-
General Aviation	1,890	2,016	2,151	2,294	2,447	1.30%	1.30%	1.30%	1.30%
Military	-	-	-	-	-	-	-	-	-
Total Itinerant Operations	1,890	2,016	2,151	2,294	2,447	1.30%	1.30%	1.30%	1.30%
Local									
Civil	4,410	4,704	5,018	5,353	5,710	1.30%	1.30%	1.30%	1.30%
Military	-	-	-	-	-	-	-	-	-
Total Local Operations	4,410	4,704	5,018	5,353	5,710	1.30%	1.30%	1.30%	1.30%
TOTAL OPERATIONS	**6,300**	**6,720**	**7,169**	**7,647**	**8,157**	1.30%	1.30%	1.30%	1.30%
Annual Instrument Approaches	-	-	-	-	-	-	-	-	-
Peak Hour Operations									
Based Aircraft									
Single Engine	16	17	18	19	20	1.02%	1.02%	1.02%	1.01%
Multi Engine	2	2	3	3	4	4.06%	3.89%	3.75%	3.63%
Turbojet	-	-	-	-	-	-	-	-	-
Helicopter	2	2	2	2	2	0.48%	0.46%	0.44%	0.42%
Other	1	1	1	1	1	1.55%	1.55%	1.55%	1.55%
TOTAL BASED AIRCRAFT	**21**	**22**	**24**	**25**	**27**	1.30%	1.30%	1.30%	1.30%
B. Operational Factors									
GA Ops per Based Aircraft	300	300	300	300	300				

Source: KLJ Analysis. Note: Some figures are rounded